

SPACAL simulation update

Jin Huang (BNL)

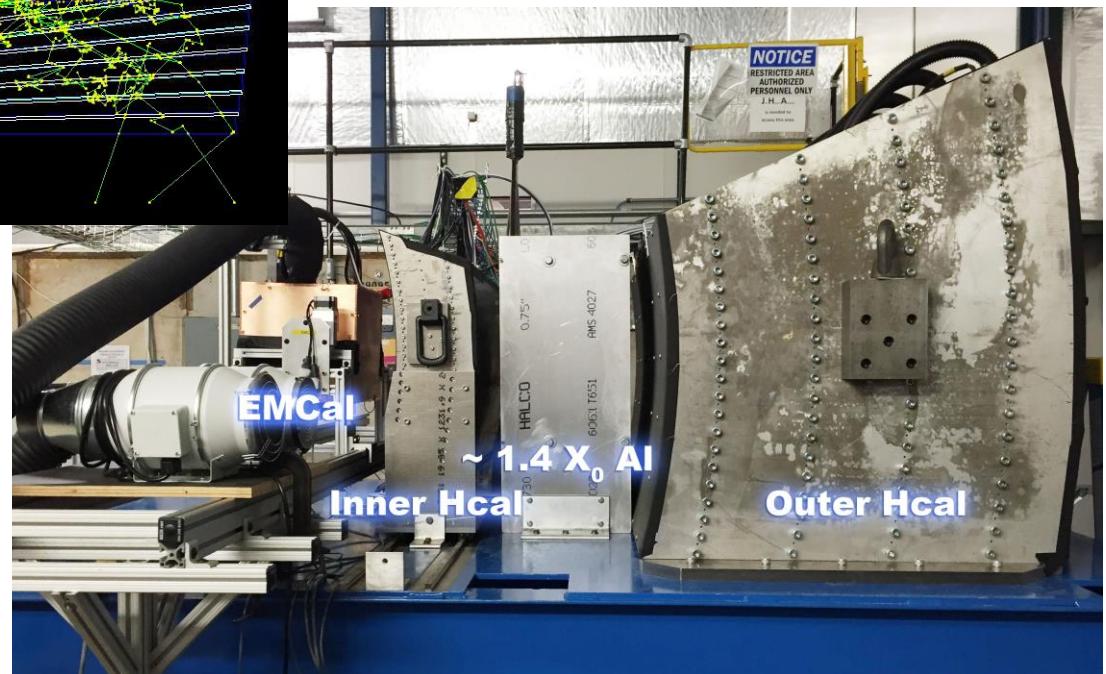
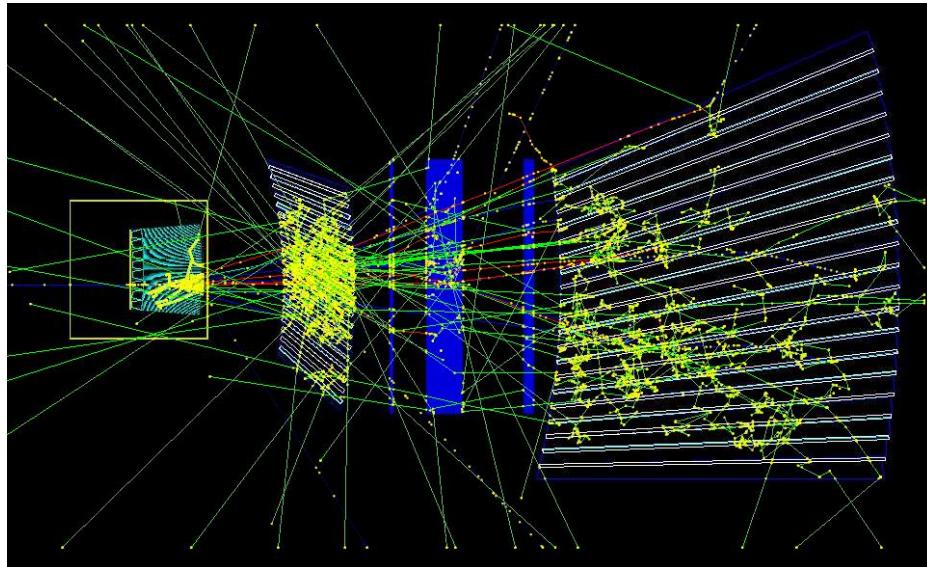
Test beam simulation tutorial

► One macro that does all

```
[jinhuang@rcas2073 test]$ git config --global http.proxy http://192.168.1.165:3128 #  
if this is first time you run git in your account  
[jinhuang@rcas2073 test]$ git clone https://github.com/sPHENIX-  
Collaboration/macros.git  
[jinhuang@rcas2073 test]$ cd macros/macros/prototype2/  
[jinhuang@rcas2072 prototype2]$ source /opt/sphenix/core/bin/sphenix_setup.csh -n  
# setup sPHENIX environment if not already done so  
[jinhuang@rcas2072 prototype2]$ root  
root [] .x Fun4All_G4_Prototype2.C(-1) // here negative value in event number start an  
event display of one event  
root [] .L DisplayOn.C  
root [] PHG4Reco* g4 = DisplayOn()  
root [] Fun4AllServer *se = Fun4AllServer::instance();  
root [] se->run(1)
```

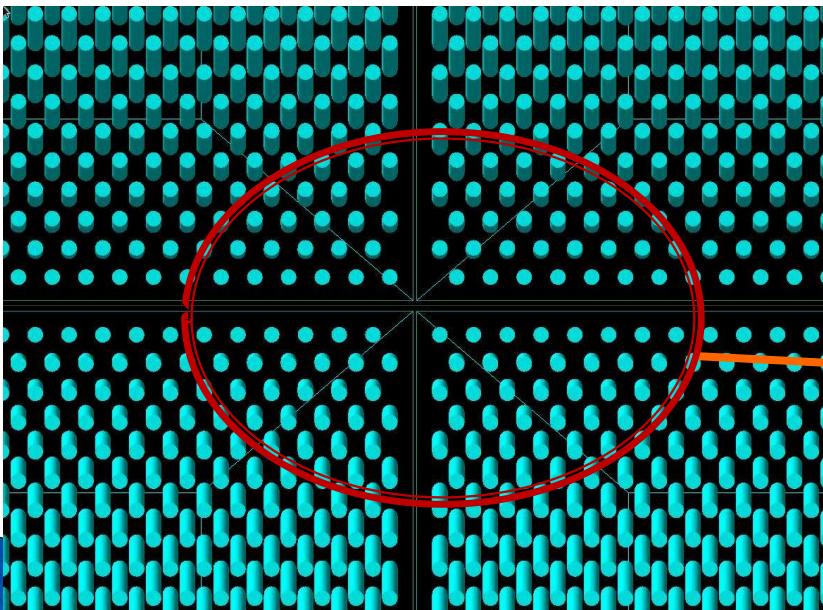


Test beam simulation tutorial: result



What we already have in SPACAL?

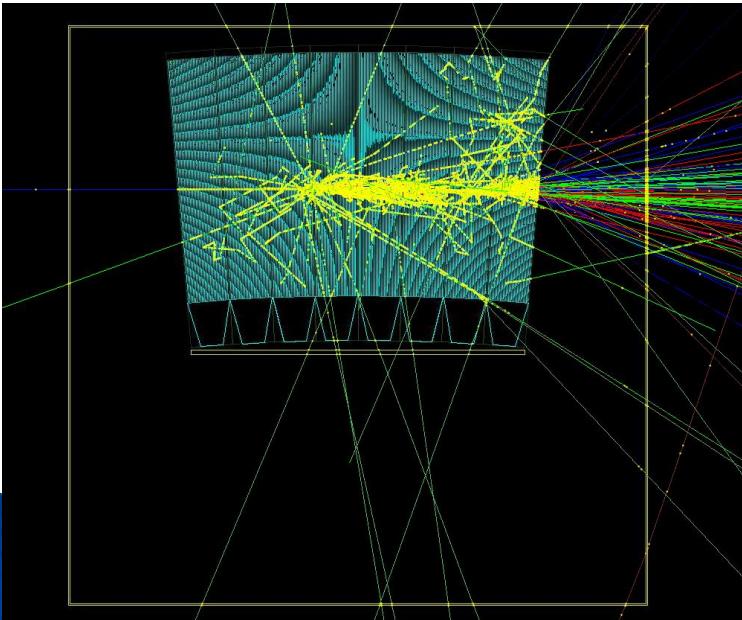
- ▶ Detailed modeling of fiber and assembly spacing
 - 18 mil W shell outside the fiber matrix due to machining residual
Is this realistic enough?
 - Diameter-470um fibers in 1mm triangle matrix and protective in the vertical direction
 - 0.1 mm horizontal assembly spacing
 - 0.33 mm vertical assembly spacing



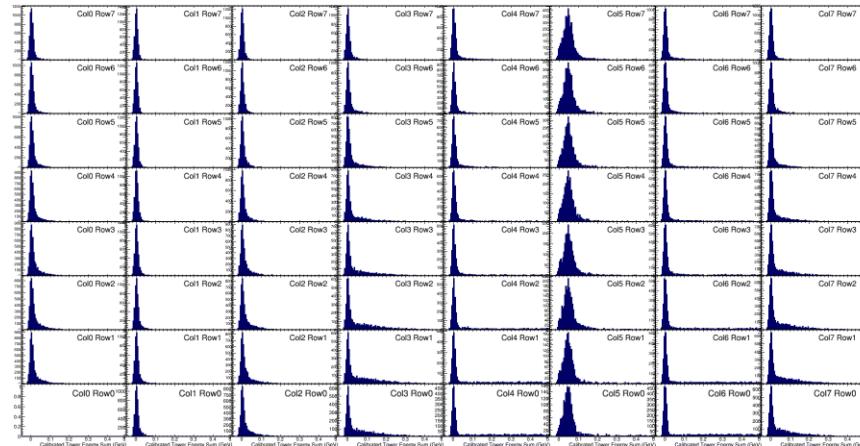
Sean Stoll (BNL)

What we already have in SPACAL?

- ▶ Test beam enclosure, light guide and electronics
- ▶ Free parameter to adjust position and rotation
- ▶ Digitization simulation with SiPM noise, convert to ADC amplitude, and calibration
- ▶ Save tower structure for calibrated tower as real data

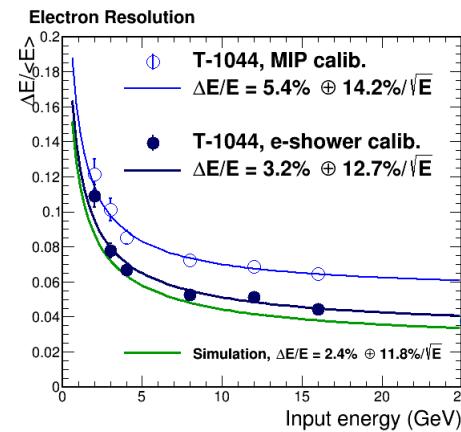
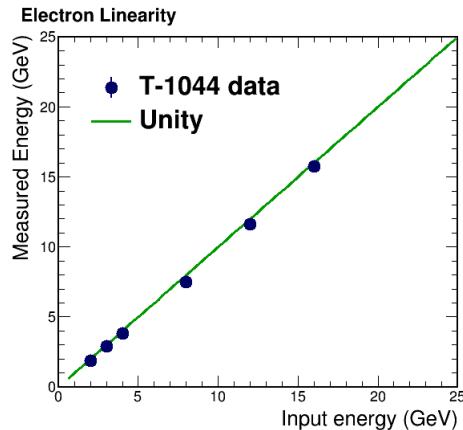


Rotated to face down for 120 GeV proton calibration

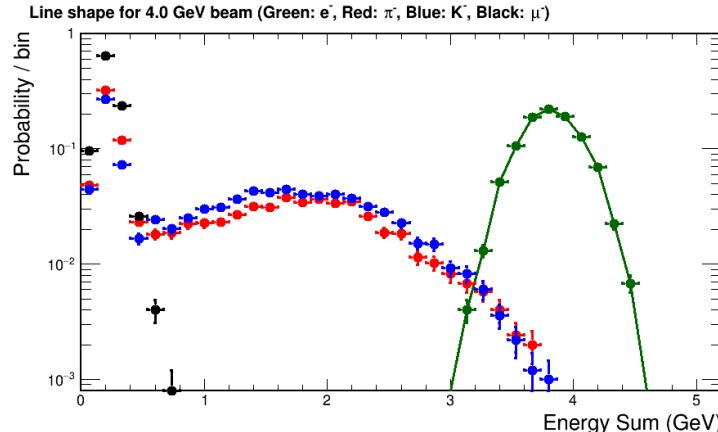


What we already have in SPACAL?

- ▶ Performance prediction for data



Next: details for the
finer differences

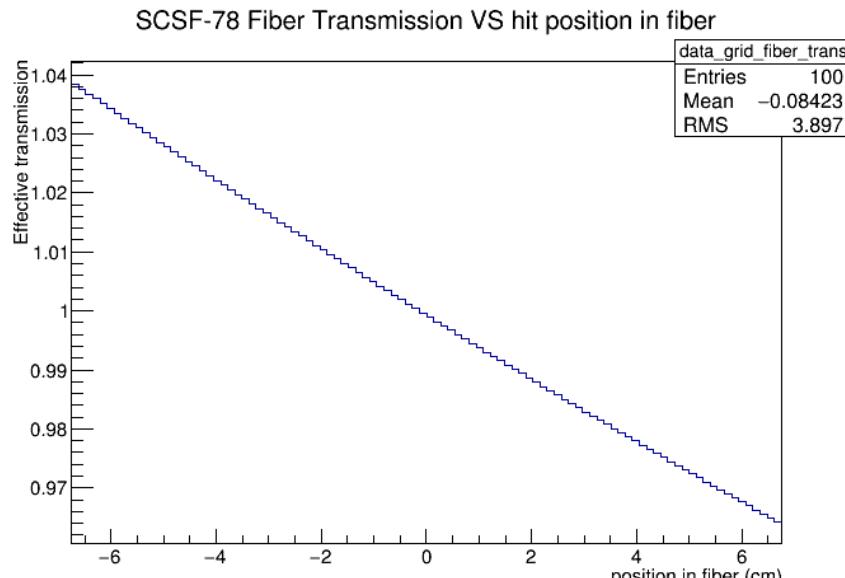


Newly introduced 1/2: scintillator fiber model

- ▶ Utility introduced for any subsystem to easily fetch local coordinates:

<https://github.com/sPHENIX-Collaboration/coresoftware/commit/ac9ae806aaa29d3c774830a16dfd4b0c3e694a91>

- ▶ Light attenuation and reflection in SPACAL fiber
 - SCSF-78 scintillation fiber spec: attenuation ~ 105 cm for short fiber
 - Reflector at the non-readout end: eff. $\sim 30\%$

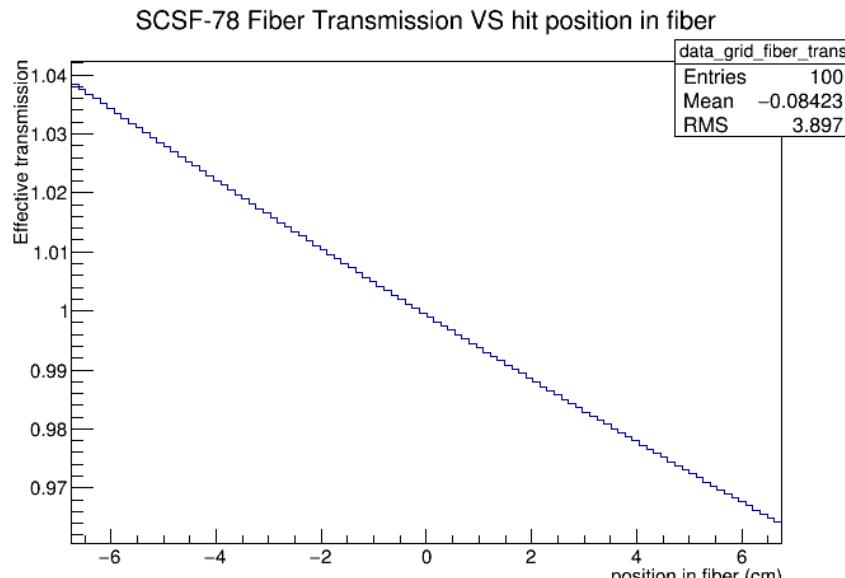


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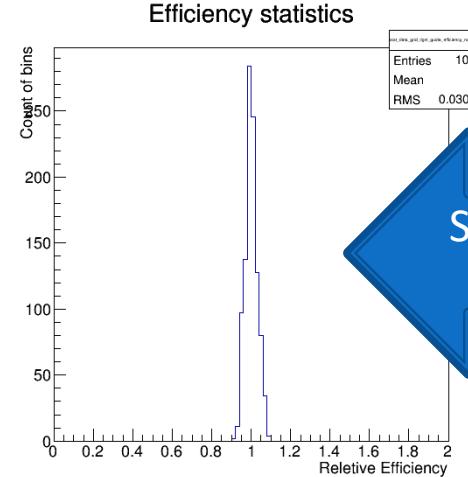
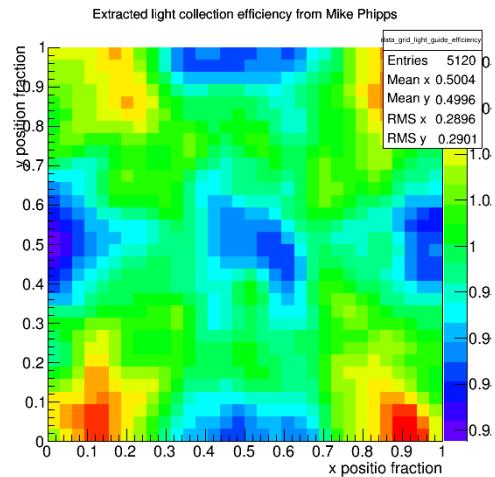
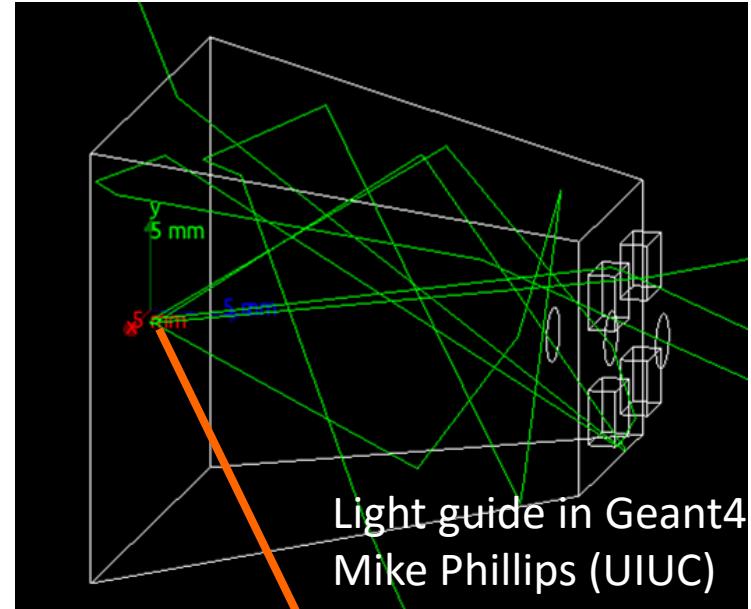
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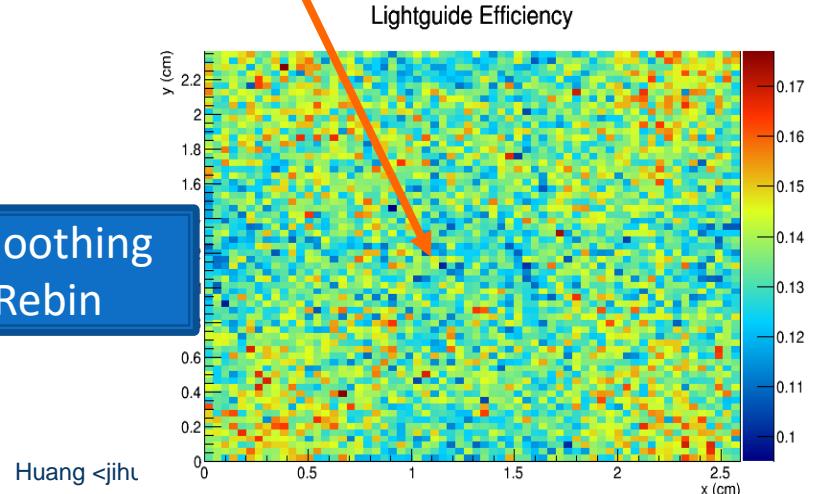
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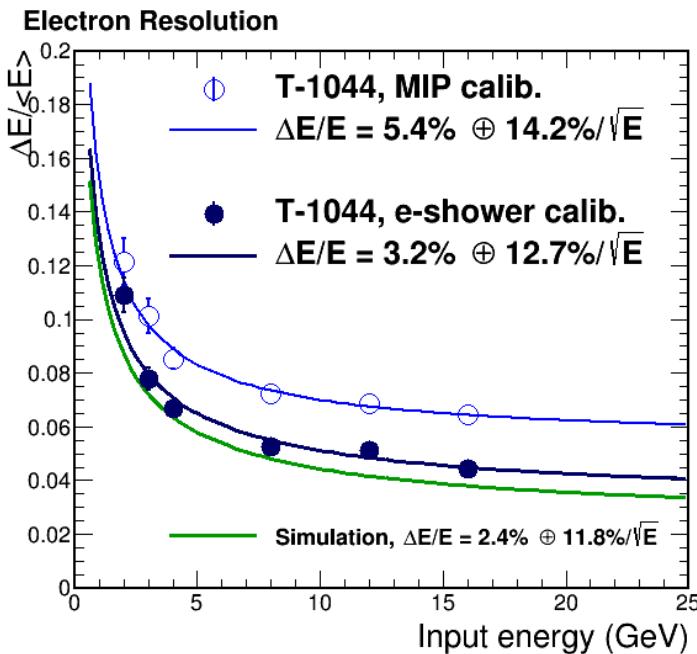
Newly introduced 2/2: Light guide model



Smoothing
Rebin



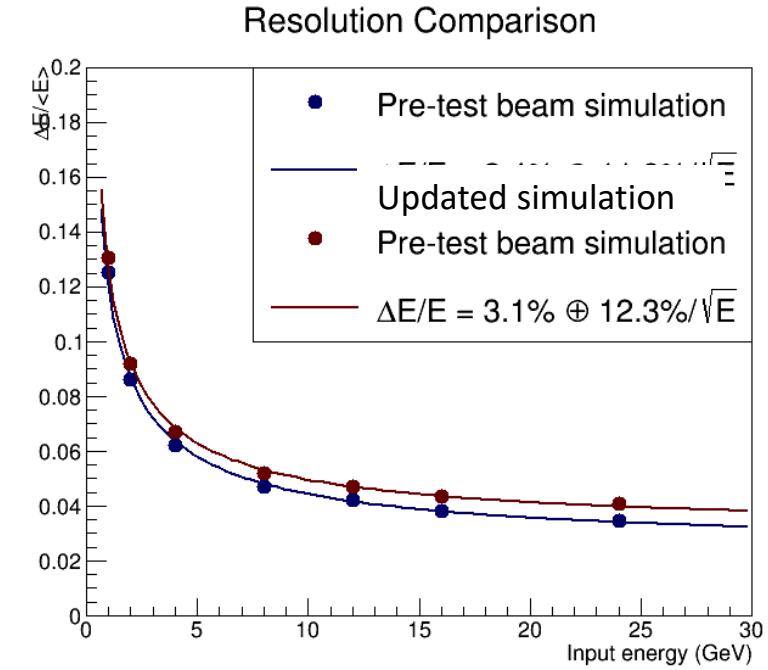
Effect on energy resolution



Preliminary plot
with pre-test beam simulation

Updated simulation include:

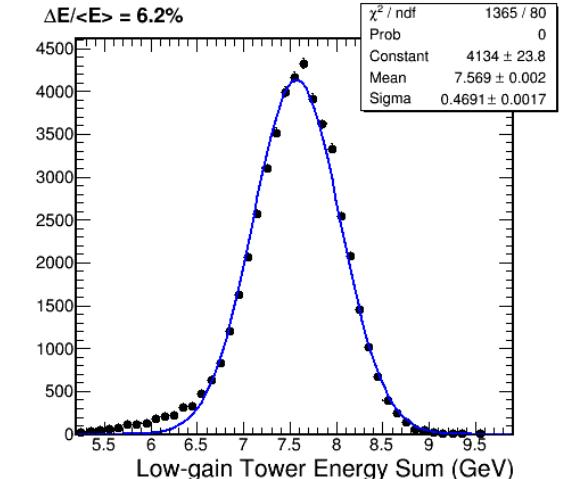
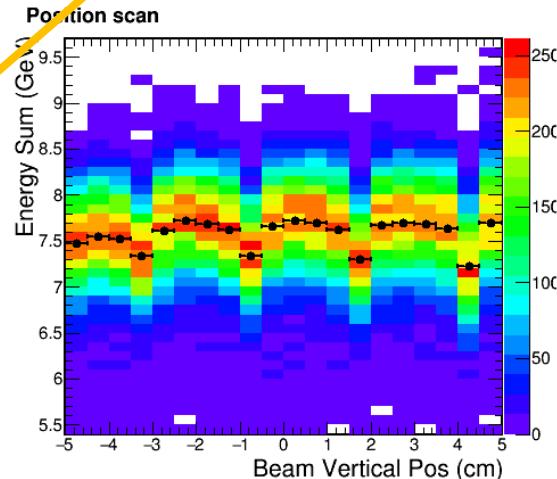
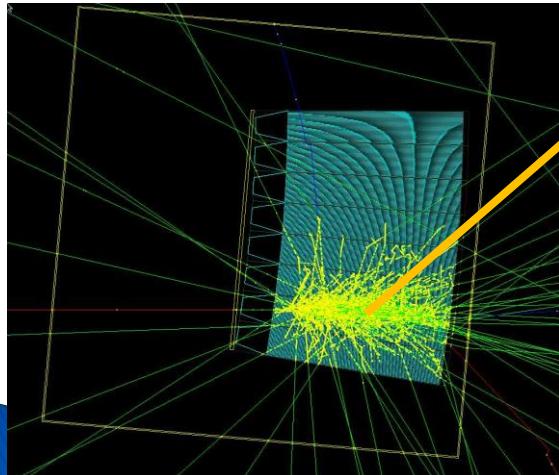
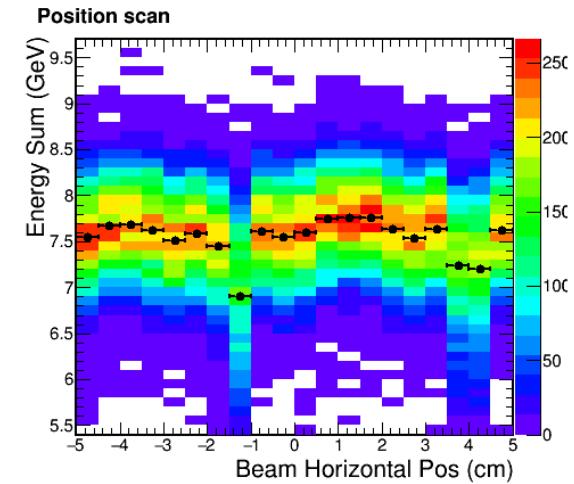
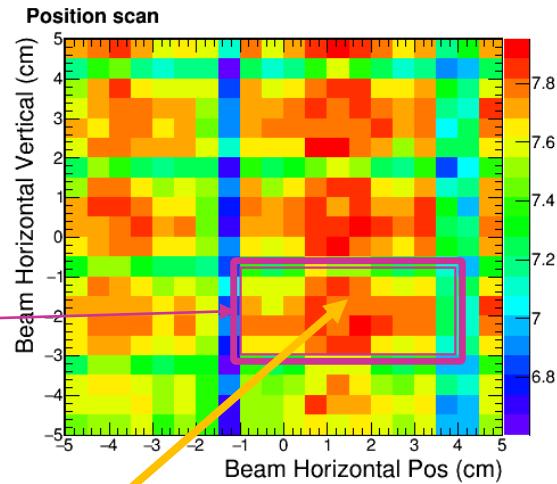
- Fiber attenuation, light collection eff.
- Beam spot from $\sigma=3\text{mm} \rightarrow 7\text{mm}$



Updated simulation
comparison

Check boundary between blocks

8 GeV e-beam in Geant4



Next

- ▶ Sean Stoll is measuring testbeam light guide light collection efficiency to cross check G4 simulated map
- ▶ Adjust module gaps
- ▶ Compare with final beam data analysis, check consistency in boundary scans
- ▶ Update final plot to go with data

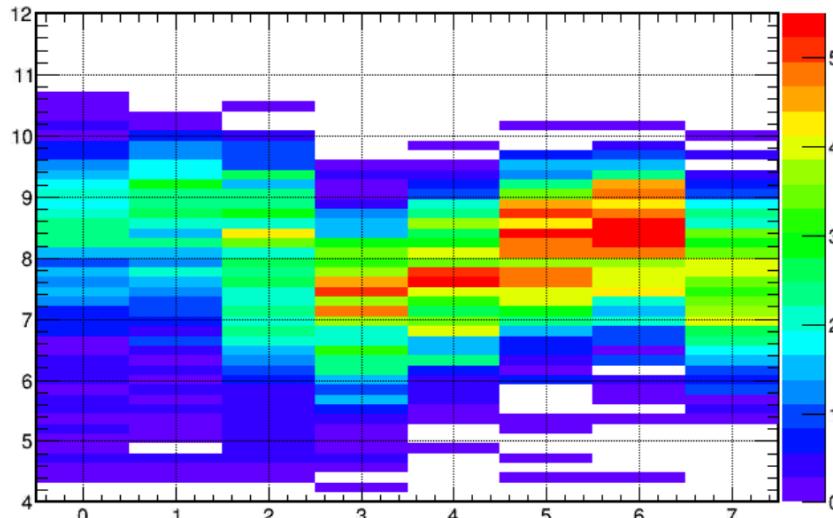
Extra information



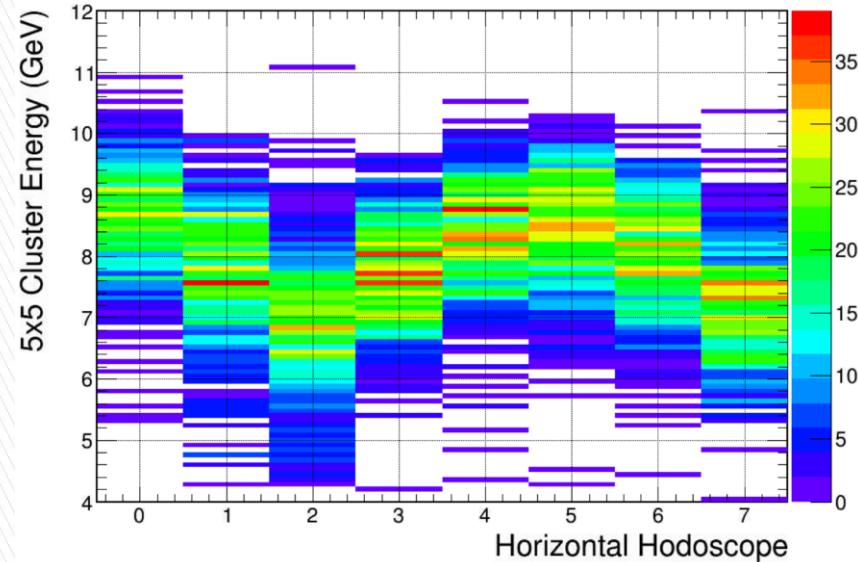
Position scan data

Run 2609, up tilt 5 degree, 8 GeV electron

Energy_Sum_col2_row2_5x5:Average_HODO_VERTICAL {C2_Sum_e>100}



Energy_Sum_col2_row2_5x5:Average_HODO_HORIZONTAL {abs(C2_Inner_e)>100}



Vertical Scan (each step is cut on 5mm vertical)

Horizontal Scan (each step is cut on 5mm horizontal)